

The Complexity of Infrastructure Interdependencies

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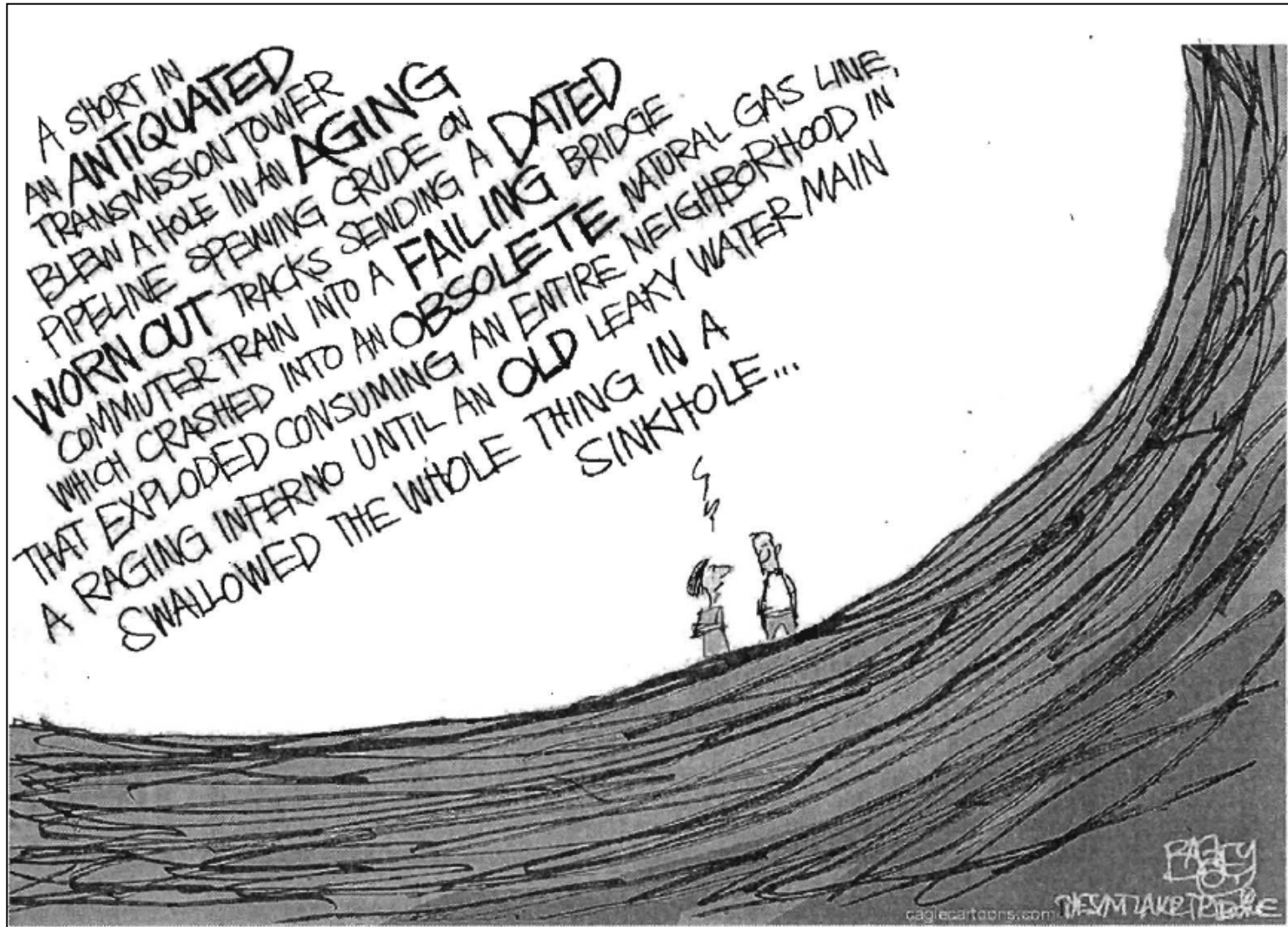
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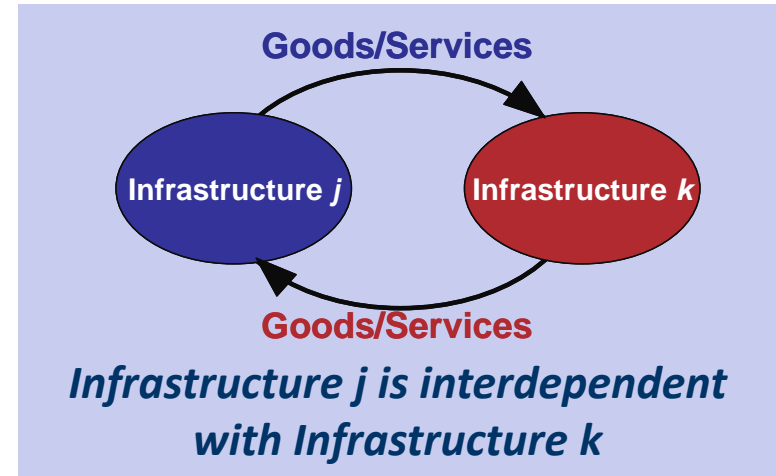
A Glimpse at the Problem



How Do We Define Interdependencies?

- **Definition:** mutually reliant relationship between entities (objects, individuals, or groups)
- Eighteen Critical Infrastructure and Key Resources (CIKR) to consider
- CIKR includes physical, cyber, and/or human elements
- A series of incidents (natural or man-made) could interact (cascade) across critical infrastructures to degrade the service upon which all depend

Infrastructure Interdependencies



Critical Infrastructure and Key Resources

Critical Infrastructure Sectors

- | | |
|--------------------------------|---------------------------|
| ■ Energy | ■ Agriculture/Food |
| ■ Transportation Systems | ■ Water |
| ■ Banking and Finance | ■ Public Health |
| ■ Chemical | ■ Emergency Services |
| ■ Postal and Shipping | ■ Defense Industrial Base |
| ■ National Monuments and Icons | ■ Information Technology |
| | ■ Telecommunications |
| | ■ Critical Manufacturing |

Key Resources

- | | |
|-------------------------------|-------------------------|
| ■ Commercial Nuclear Reactors | ■ Government Facilities |
| ■ Dams | ■ Commercial Facilities |

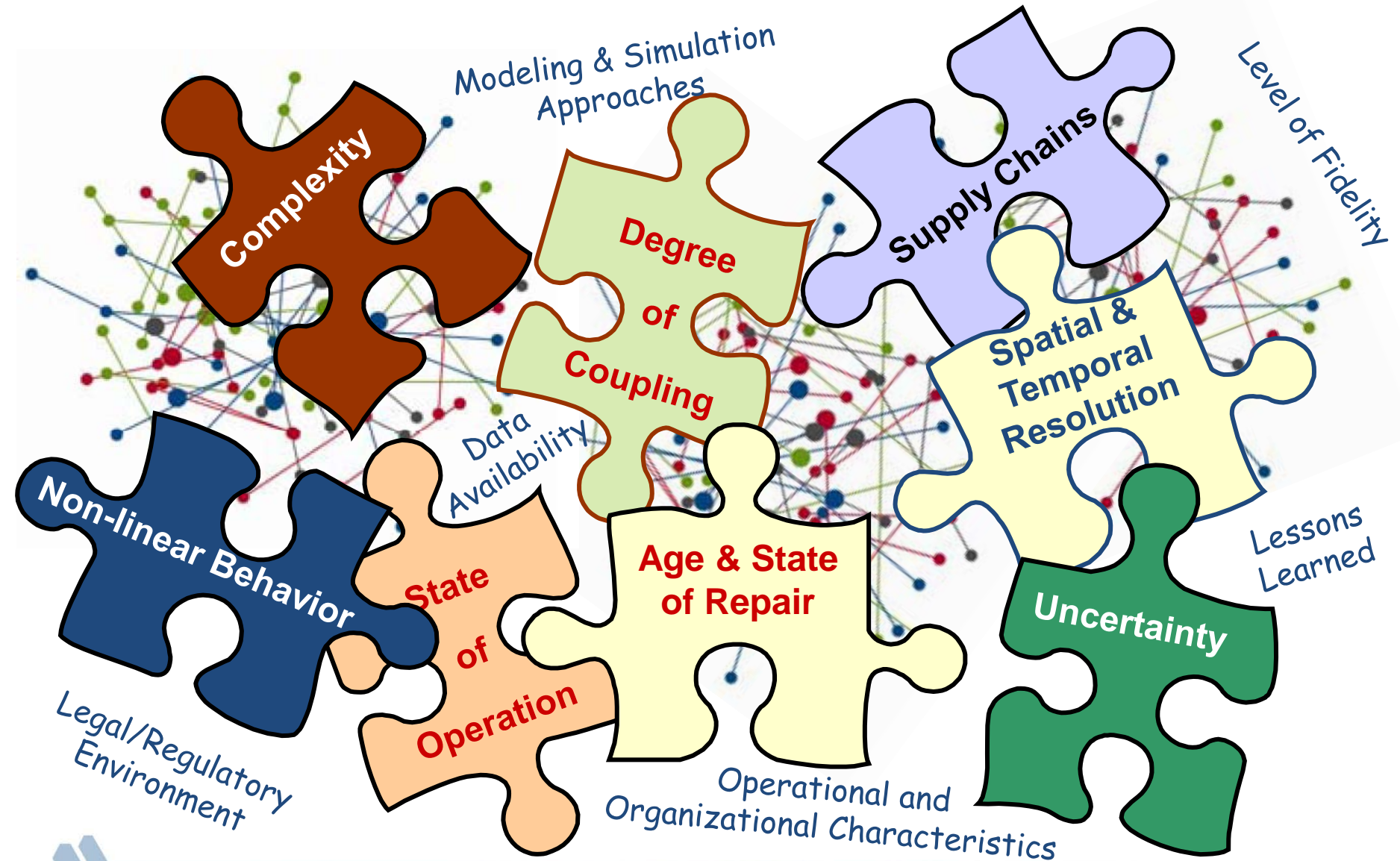
What Do We Know About Infrastructure Interdependencies?

- **Interdependencies are intuitive, but often not easily identified and without well-defined borders**
- **Our increasing reliance on information technology and telecommunications has increased interdependencies**
- **Interdependencies transcend individual public and private-sector organizations**
- **Infrastructure linkages vary significantly in scale and complexity — local, regional, national, global**
- **Despite progress, gaps exist in our capability to analyze multiple contingency events involving interdependent infrastructures**
- **Data are often limited and sensitive/proprietary**

**Understanding interdependencies requires
a “system-of-systems” perspective**



What Factors Need to be Considered When Addressing Infrastructure Interdependencies?



What Actions Can Be Taken to Mitigate Potential Interdependency Problems?

- **Identify internal and external infrastructure assets, systems, and networks that, if lost or degraded, could adversely affect performance – and how they are connected**
- **Study natural disasters and incidents to gain insight into interdependencies problems and solutions**
- **Develop contingency plans to deal with cascading outages (conduct “what if” analysis)**
- **Identify how backup systems and other mitigation mechanisms can reduce interdependencies problems**
- **Address security in contractual arrangements (you are only as secure as your suppliers and distributors)**
- **Collaborate, cooperate, participate, and exercise**
- **Avoid “failure of imagination”**



What Are Possible Next Steps?

- The problem is difficult
- We all agree that we need to consider interdependencies in making CIKR protection and resilience investment decisions, but there is no silver bullet
- Data and modeling issues are complex
- Where do we start?

